



**Wireless computing.
Changing the way
we live and learn.**

**Intel® Centrino™
mobile technology.**

**Notebook PCs and
wireless LANs for
higher education**



The mobile generation has arrived.

Today's students — and their teachers — are extremely mobile. Between classes, jobs and their social lives, they're always on the move — but always in touch.



A quick look inside their backpacks and briefcases confirms why. Wireless devices like cell phones, pagers, handhelds and notebook PCs are changing the way students and teachers communicate and collaborate with each other.

For many students, a wireless-enabled notebook PC is an important tool. Notebooks make collaboration between students, teachers and administrators easier and more convenient. They improve productivity by allowing people to work from any place where appropriate wireless infrastructure is set up. And they help prepare students for the real world by improving their computer literacy and familiarizing them with the latest computing technologies.

Wireless local area networks (WLANs) are becoming the networking choice for higher education. The proof is in the numbers: According to findings from the 2003 Campus Computing Project,¹ college campuses are going wireless en masse. By the fall of 2003, more than 45 percent had developed strategic plans for wireless networks, up from 34.7 percent in 2002 and 24.3 percent in 2001.

Almost four-fifths (77.2 percent) of the campuses participating in the 2003 survey reported that they are currently using WLANs. That compares to two-thirds (67.9 percent) in 2002 and just 29.6 percent in 2000. One-seventh (14.2 percent) of those that responded indicated that full-campus wireless networks are up and running at their institutions as of fall 2003, compared to a tenth (10.0 percent) in 2002 and just 3.8 percent in 2000.

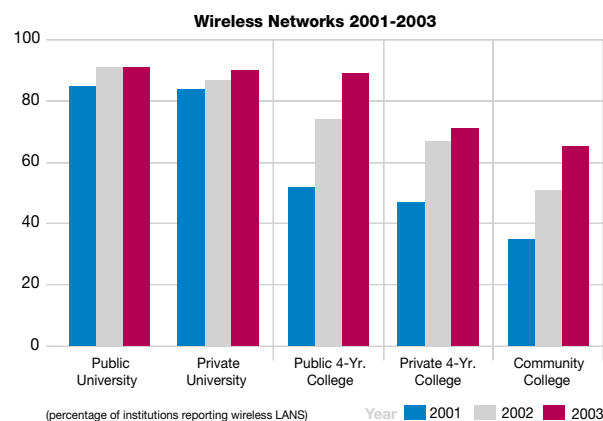
"Wireless is clearly exploding across college campuses, much as it has in the corporate and consumer sectors," says Kenneth C. Green, director of the Campus Computing Project. "Rising expectations about wireless services are fostered in part by the recent, dramatic growth of inexpensive Wi-Fi* in the consumer sector."

90 percent of Dartmouth College's freshman class arrived with wireless-enabled laptops. "No one wants to plug in anymore," says Brad Noblet, Dartmouth director of technical services.²

"Innovative thinking is a given at universities. Innovative technology should be as well," insists Nextel president and CEO Tim Donahue, after Nextel integrated cellular/WLAN service across the John Carroll University's 60-acre campus.³

Notebook computing and WLANs are transforming education. Learn more about the benefits and freedom notebook PCs and WLANs offer students, faculty and staff. And discover why Intel® Centrino™ mobile technology — the first mobile Intel technology built from the ground up with wireless LAN capability+ in mind — is the intelligent choice for campus computing.

WLAN on campus



Source: 2003 Campus Computing Project

Notebooks: A smart investment for the future.

A notebook deployment program will do more than just improve education at your college or university; it will revolutionize it. Students, teachers and administrators alike all stand to gain from the increased convenience and productivity mobile computing offers. It also helps to reduce total cost of ownership (TCO), while delivering rapid return on investment (ROI). Let's learn how.



Students

With appropriate wireless infrastructure, wireless enabled notebook computers allow students to take their studies with them — far beyond the constraints of the traditional classroom or computer lab. They offer the freedom to access worldwide resources via the Internet with WLAN connectivity,⁺ so students can:

- Study when and where they want — under a tree, in their dorm room or at their favorite coffeehouse.
- Collaborate with friends by sharing notes and information in study groups that can be held in a variety of locations.
- Conduct research, access study guides, plan and make presentations and conduct online discussions — wherever is most convenient.
- Communicate with professors, get class notes, participate in class work and access worldwide databases — connecting with greater freedom to the school's wireless network.⁺

“[Notebook] computers can add tremendously to the learning that takes place in the classroom. And they can take learning and technology out of the classroom and into student internships, their dorm rooms or residence halls and their favorite spot under a tree.”

Alan Brinton, Vice President for Academic Affairs,
Albertson College of Idaho



This mobility often results in students becoming more excited about learning. They're engaged from the moment they take on new projects — and that engagement leads to a more rewarding educational experience.

Teachers and administrators

Notebook computing lets professors and instructors do something they've wanted to do for years: lose the chalkboard. By using a notebook PC in the classroom, they can engage students through more interactive and progressive teaching methods. Notebook PCs also help administrators streamline paper processes and reduce overhead, dramatically increasing productivity. Some professors are even using "smartboards" that are similar to white boards, but are connected to their notebook PC. Everything they write on the smartboard — from announcements and class notes to test results — can be quickly and easily loaded onto the faculty member's Web site.

Today's professors are using notebook PCs to:

- Make lectures more interesting and vibrant with videos, presentations and music.
- Make classes more interactive by allowing students and teachers to communicate one on one, in small groups or with the entire class using electronic instructional communications.
- Conduct simulations on the screen in real time, such as moving notes around on a virtual piano to hear new chords, or watching the effects of changing weather patterns.
- Run virtual experiments instead of expensive, time-consuming lab exercises.



Why mobile computing makes sense.

There are plenty of reasons to turn your campus into a notebook-friendly place. Here are just a few:

- Facilitate easy collaboration between teachers, students and administrators — in the classroom and across campus.
- Prepare students for the computer-driven job market and business environment.
- Provide cost-effective investments in your IT infrastructure.
- Develop a dynamic computing environment that appeals to potential students, teachers and administrators.

“We think that there are significant benefits associated with wireless for Kellogg and that these benefits greatly outweigh the incremental costs associated with deploying wireless.”

Catherine Grimsted, Associate Dean of Finance,
Technology and Planning, Kellogg School of Management,
Northwestern University

Intel Centrino mobile technology is the wireless PC solution.

Intel is always working to find new ways to make computing more powerful, more convenient and more mobile. In essence, we're working to give students and educators the tools they need to make the most of the educational experience. Intel Centrino mobile technology, featuring the integrated Intel® PRO/Wireless 2200BG Network Connection 802.11b/g

module, does just that.[∞] When mobile PC users choose Intel Centrino mobile technology, they can get more of what matters most to them — integrated WLAN capability, breakthrough mobile performance and, when enabled properly, extended battery life in lighter, easier-to-carry designs.⁺



Untangle.

Integrated WLAN capability⁺

- Single band 802.11b, single band/dual mode 802.11b/g and dual band 802.11a/b Wi-Fi CERTIFIED⁺ WLAN support.[∞]
- Industry-standard WLAN security support for 802.1x, Wired Equivalent Privacy (WEP) and Wi-Fi Protected Access⁺ (WPA)[§] is available.
- Cisco⁺ Compatible Extensions, such as LEAP and CKIP support, are available on certain models. Check with your PC manufacturer for details regarding availability.⁺§ With PC manufacturer's availability and validation, this enables interoperability with Cisco Aironet⁺ WLAN infrastructure.



Uncompromise.

Breakthrough mobile performance⁺

- Students and teachers accomplish more in less time thanks to the processor's enhanced data buffering, efficient execution engine and advanced instruction prediction.
- A larger L2 cache of 2 MB stores even more recently used data and instructions than previous processors, improving system response.
- The Intel® 855 chipset family offers a choice of graphics performance to meet unique user needs.
- Exceptional performance for business and content creation applications.



Unstress.

Enables extended battery life⁺

- Intel® Intelligent Scanning Technology reduces power consumption by controlling the frequency of scanning for access points.
- Lower-voltage chipsets and better power management enable extended battery life.
- Enhanced Intel SpeedStep[®] technology matches processor performance to application demand.



Unburden.

Thinner, lighter designs

- Intel Centrino mobile technology is designed specifically for sleek, lightweight wireless notebook PCs, such as the thin and light subnotebook, mini-notebook and tablet PCs.
- Thanks to integrated WLAN capability,⁺ students and faculty avoid the hassles of separate wireless adapters, network ports, telephone jacks and cables.

How Intel® Centrino™ mobile technology-based notebooks enhance education.

Feature	Benefit
Productivity	Students and educators are free to work when and where they want. Their notebook PC and a WLAN connection ⁺ let them conduct research while sitting in the student union or download course materials while watching TV in their dorm room.
Multitasking	Simultaneously taking notes, searching the Web and participating in course-directed chat — that's the future of higher education classrooms. A notebook PC with integrated WLAN capability ⁺ lets students make the most of their time by allowing them to do more at once.
Multimedia	Students and teachers can load audio and video clips onto the school's network servers, then stream them to their notebook PCs during in-class presentations and lectures using a WLAN. ⁺ It's a whole new way to bring life to learning.
Communication and collaboration	Freeing people to communicate and work together is one of the ultimate advantages that notebook PCs and WLANs bring to education. ⁺ Virtual conferencing helps students, teachers and administrators stay in touch and on track with collaborative projects.
Video editing and encoding	Film students can work all semester shooting scenes on location, then save their digital video files on the school's server. When they're ready to start editing their cinematic masterpiece, they can beam the raw footage to their notebook PCs for editing. They can even share clips with other film students by beaming footage directly from one notebook PC to another using an ad hoc, peer-to-peer network.
Internet	With a notebook PC and integrated WLAN capability, ⁺ students can download course-related Flash* animations, streaming videos and presentations — while they listen to lectures. It's one more way educators can bring the unlimited possibilities of the Internet into the classroom.
Content creation	Today's educators can create unique materials and save them as PDFs on the network. Students can download course materials daily via the WLAN, ⁺ saving time and empowering them to get the information they need at the precise moment they need it.

The flexible solution for computing and communicating.

Intel Centrino mobile technology with integrated WLAN capability⁺ offers students and faculty outstanding flexibility. For instance, in the morning, two students can work on a bandwidth-hungry CAD program in the engineering lab, which is set up with an 802.11a access point. Then in the

evening, they can eat dinner and check e-mail in the student union building, where only an 802.11b public hotspot is available. No matter where they are — on campus or at home — the integrated WLAN capability of Intel Centrino mobile technology makes it easy to get connected and stay productive.

Intel processor-based notebooks deliver a stable platform for a quality WLAN experience.

Free of wires, students and teachers can roam across campus, working on projects wherever it's most convenient. Intel's recommended Stable Image Platform Program takes the guesswork out of what to deploy and when.

Intel's industry-leading compatibility and validation testing allows IT departments to roll out wireless platforms and WLAN infrastructure with confidence. Students, faculty and the IT department can all enjoy the reliability that image stability and transition guidance provide.

Intel Centrino mobile technology is at the core of Intel's Stable Image Platform Program. It includes three key components: the Intel® Pentium® M processor, Intel® 855 chipset and Intel® PRO/Wireless Network Connection based on IEEE 802.11 standards. These three components are tested and tuned to work together to maximize interoperability. Because all of Intel's integrated WLAN capability options include 802.11b network connectivity, they work with the most widely used and supported WLAN infrastructure available today.







Intel Centrino mobile technology with 802.11b: the right wireless solution

When it comes to WLAN connectivity, there are three major standards defined by IEEE: 802.11a, 802.11b and 802.11g. While each standard has its strong points, 802.11b is by far the most widely supported standard used in today's WLANs — and will continue to be a leading wireless technology for years to come.

Since its introduction in 1998, millions of people have taken advantage of 802.11b wireless technology to free themselves from traditional wired networks. Almost any WLAN you encounter is likely to support 802.11b notebooks and other devices — either through dedicated 802.11b access points, dual band 802.11a/b access points or new 802.11g access points, which are backwards-compatible with 802.11b. Notebooks based on Intel Centrino mobile technology with integrated WLAN capability+ enable you to get connected with the freedom of wireless.



Key features and benefits of WLANs.⁺

Feature	Benefit
Ease 	WLAN components simplify installation. For example, wireless gateways and access points can be set up much faster than a wired network that requires drilling holes in walls and running new wires through older buildings.
Security 	Securing your WLAN isn't overly difficult and only requires minimal effort on your part. Today, many vendors offer easy-to-use products for enabling firewalls, WEP encryption, WPA and VPNs. These solutions enable students, teachers and administrators to more securely collaborate with each other.
Speed 	WLAN networks offer data rates up to 11 Mbps or 54 Mbps. This means quick access to the Internet, printers and other network-based resources.
Flexibility 	Adding more users is as easy as adding a few notebook PCs with integrated WLAN capability. Expanding coverage or bandwidth is just a matter of adding another gateway or access point.
Cost-effectiveness 	Wireless gateways let multiple users simultaneously share a single Internet account, saving multiple monthly fees.
Compatibility 	Wireless components are based on the IEEE 802.11a, IEEE 802.11b or IEEE 802.11g standard (Wi-Fi CERTIFIED* products carry the Wi-Fi* logo). This ensures compatibility and allows buyers to mix and match network components from different vendors. And future standards-compliant products will operate with existing wireless equipment — helping to protect and extend the life of technology investments.

Evaluating the ROI and TCO of WLANs.

The decision to implement a WLAN on campus should be based on an assessment of anticipated benefits versus required investment for the technology. In short, you should look at Return on Investment (ROI) and Total Cost of Ownership (TCO).

Measuring ROI

In terms of measuring ROI, you need to ask two questions: How quickly can you recover the costs? And what does your institution stand to gain from the investment?

A study by the WLAN Association (WLANA) found that the average time to fully recoup the initial costs of a typical WLAN installation was less than one year.⁴ But besides rapid ROI, WLANs offer a number of benefits. They enable your institution to install only the amount of networking you need today. As your school grows, you can build on the stable technology that is already in place. So there are no ongoing construction costs or the hassles of continually running new wires.

The real gain from a wireless network, however, comes from increased productivity. According to a study by NOP World Technology, wireless network users increased productivity by 22 percent.⁵ And 87 percent of end users believe using a WLAN improves their quality of life by increasing flexibility, productivity and time-savings.⁶ Using their notebook PCs, and with appropriate wireless infrastructure installed, students, teachers and administrators can check e-mail while they are waiting for a class to start, conduct research on the Web as they eat lunch in the student union, and generally do more in less time.

Determining TCO

Regarding TCO, wireless technologies have advanced to the point where nearly every academic institution can benefit. For example, the performance and reliability you would expect from a robust wired network is now available with wireless technology — at a price most public institutions can afford. In fact, WLANA noted that 92 percent of customers found definite economic and business productivity benefits with a wireless solution that lets students and educators work where they want, when they want.⁷

Realizing the total benefits of wireless computing.

- 92 percent of wireless users found definite economic and business productivity benefits with a wireless solution.⁸
- 87 percent of users believe that using a WLAN improves their quality of life by increasing flexibility, productivity and time-savings.⁹
- Wireless network users increased productivity by 22 percent.¹⁰
- The average time to fully recoup the initial costs of a typical WLAN installation was less than one year.¹¹
- Institutions can grow their network gradually.

Notebooks and WLANs can deliver major savings.

- WLANs deliver immediate savings in the short and long term.
- Increased productivity — people can do more in less time.
- Fewer Internet accounts and costs — a single Internet account can support multiple wireless network users.
- Lower infrastructure costs — WLANs eliminate the expense of running wires through walls and floors.
- Lower support costs — WLANs enable cost-efficient management of users, applications and security functions.

“Overall, over 80 percent of organizations with wireless LANs are using notebook computers as the primary network access platform.”

Study conducted by NOP World Technology on behalf of Cisco Systems,
November 2003: “2003 Wireless LAN Benefits Study”



Wireless is here to stay.

Besides an increase in the use of mobile PCs, wireless infrastructure is growing quickly — on campuses and in cities around the world. IDC predicts that “Wi-Fi* hotspots will continue to proliferate, nearly doubling worldwide from 50,000 in 2003 to almost 85,000 in 2004.”¹²

Research also indicates that “nearly 120,000 WLAN hotspot gateways will exist worldwide” by 2007¹³. This ubiquitous coverage will ensure easy network access to students and teachers who use notebook PCs with integrated WLAN capability — even when they are studying across town or across the globe.

Learn more today.

**Intel Centrino mobile technology
featuring integrated WLAN capability* makes
freedom from wires a reality.**



**A wireless network gives students and
educators the flexibility to work, learn and
study with more freedom than ever. So they
work more efficiently and enjoy a better
educational experience. That's why notebook
PCs with integrated WLAN capability and
campuses with WLANs represent the
future of campus computing.**



**Find out how Intel Centrino
mobile technology-
based notebook PCs can
help you move into
the future with ease.**

**To learn more,
visit us on the Web at:**

intel.com/products/notebook

intel®

intel.com/products/notebook

+ Wireless connectivity and some features may require you to purchase additional software, services or external hardware. Availability of public wireless LAN access points limited and some hotspots may not support Linux-based Intel Centrino mobile technology systems. System performance measured by MobileMark® 2002. System performance, battery life, wireless performance and functionality will vary depending on your specific operating system, hardware and software configurations. See http://www.intel.com/products/centrino/more_info for more information.

∞ Dual band WLAN supports low band capabilities (5.15 GHz to 5.35 GHz) only. Low band capabilities are not supported in all countries. Check with your PC manufacturer for details on availability.

§ Some security solutions may not be supported by your PC's operating system and/or by your PC manufacturer. Check with your PC manufacturer for details on availability.

1 Campus Computing Project, October 2003: "Campus Policies Address Digital Content and Copyright; Wireless Networks Show Big Gains," www.campuscomputing.net

2 NetworkWorldFusion, November 2003: "College WLANs Put to the Test," www.nwfusion.com/news/2003/1103campuswlan.html

3 Nextel, September 2003: "John Carroll University Deploys Campus-Wide Integrated Cellular/WLAN from Nextel and RadioFrame Networks," press release

4 WLANA, 2001: "Wireless LAN ROI," www.wlana.org/learn/roi.htm

5 NOP World Technology, Fall 2001: "WLAN Benefits Study"

6 Intel Corporation, 2001: Internal Study

7 WLANA, 2001: "Wireless LAN ROI," www.wlana.org/learn/roi.htm

8 WLANA, 2001

9 NOP World Technology, Fall 2001: "WLAN Benefits Study"

10 NOP World Technology, Fall 2001

11 WLANA, 2001

12 IDC, December 2003: "IDC Predictions 2004: New IT Growth Wave, New Game Plan"

13 Gartner, Inc., August 9, 2002: "Public WLAN Hotspots: Worldwide Trends and Forecasts (Executive Summary)"

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